

2. Eco-friendly system of sea grapes culture

1. General Information

Introduction

The Eco-friendly sea grapes culture system together with local wisdom is the guideline in the area of coastal saline soil for sustainable land use.

Sea grapes are considered to be a unicellular plant in the sea with importance to the environment. They are also part of food chain with the ecosystem to keep the natural balance of the ocean. They are important to human beings' living in terms of nutrition, supplementary food for health as well as necessity for young aquatic animals. They may function as shelters or food sources for them including prevention and removal of waste water possibly occurring in the sea water and water resources. Sea grapes work together with bacteria whereby bacteria help decompose organic compounds to be in the form of inorganic compounds and sea grapes use these compounds. For the other part, sea grapes can be used for industry and cosmetics. The extract from sea grapes is used in the pharmaceutical industry to prevent and treat diseases.

Previously, the area of this technology was *Aegiceras corniculatum*. Later, the area was changed to be the area of salt farming. In 1984, they transformed land use into Brine shrimp culture. Then once again, they faced economic, coupled with problems of environmental impact. Therefore, farmers changed utilization to sea grapes culture in 2016. This has been

Location where best practice / technology is being implemented/Country

House No. 4, Moo 3, Laem Phak Bia sub-district, Ban Laem district, Phetchaburi province.

Geographical location

Latitude 100.07979 Longitude 13.03804

Year of implementation started

The operation started in 2016

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2. Approach, aims, and enabling environment

Main purpose of best practice / technology

1. To have eco-friendly sea grapes culture systems
2. To prevent and remove waste water likely to occur in the sea water and water resources
3. To utilize coastal lands (coastal saline soil) sustainably

Technical specifications, implementation activities

1. Area selection: Growing sea grapes in the pond system requires management in terms of growing factors to be suitable for growth of sea grapes. Regarding location of the farm, it has to be far away from the community zone and industrial factories to avoid problems of discarded water from communities and pollution sources. In this aspect, it is risky for consumption. Sea grapes are seaweed in the narrow range of salinity. Therefore, farm location must be near the coast or the water must have salinity at the level of sea water such as coastal plains or areas at the mouth of the river connected to the sea. The reason for this is the fact that

water salinity can be controlled at the suitable level and it should be far away from flooding of fresh water in the rainy season. The characteristic of soil should be clay or sandy clay so that it can store water. Water used to grow sea grapes should have salinity of 27-33 parts per thousand. The sea water along the shoreline is mostly used. Moreover, there should be convenient communication.

2. Pond preparation refers to conditioning the pond floor such as the pH value, cleanliness of the pond bottom and within the pond so that sea grapes can be cultivated resulting in highest yields per pond area.

3. Management during cultivation

3.1 During cultivation, there should be water drainage about 30% by pumping water into the pond at least 1 time per week so that the sea grapes will receive nutrients, growth stimulus. This helps circulate the water. The sea grapes can absorb nutrients better. Moreover, installation of water inlets and outlets with close and open valves according to natural water levels can be done or the principle of tidal condition observation can be used together with the lunar calendar (local wisdom: waxing moon and waning moon).

3.2 Frequency of pumping water in depends on the age of cultivation and density of the sea grapes in order to increase natural nutrients, circulate water and keep the water level in the cultivation pond.

3.3 Shrimps and horse crabs are released into the pond to get rid of pests of the sea grapes and for the purpose of being supplementary incomes.

4. Yield harvesting

4.1 It takes about 3 months to grow sea grapes until they can give yields. The yields can be harvested every 2 weeks continuously for 2 years. However, harvesting cannot be conducted during June to September due to the rainy season.

4.2 In the area of 1 rai, yields of 1,200 kilograms can be harvested.

5. Management after harvesting

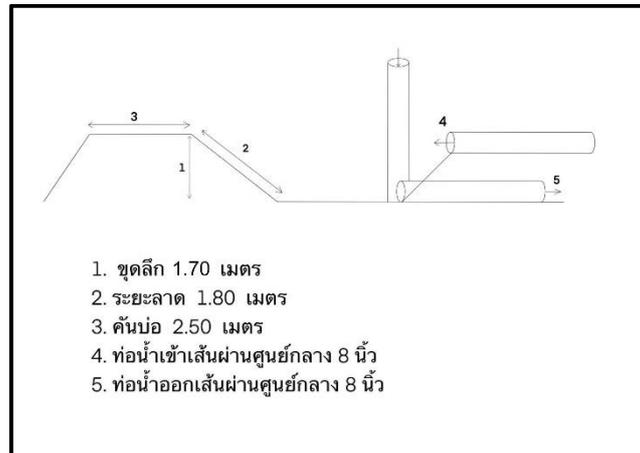
5.1 Put the sea grapes in a 500 litre storage tank. Fill it with water pumped from the pond to store the sea grapes for a night.

5.2 Sort out, clean by using the machine "skimmer" to circulate air in the water and produce very fine air bubbles. The objective of doing this is to remove dirt contaminating the sea grapes. The machine is turned on all the time not more than 3 days. during this time, the water has to be drained every day.

5.3 The process of yield packaging: After cleaning the sea grapes, shake off water from the sea grapes by using the spin and dry machine modified from the spinning bin of a washing machine for 30 seconds. Then, pack them in foam crates supported with water absorbent pads.

5.4 The age of sea grapes lasts 7 days. The sea grapes must be kept in room temperature.

Technical drawing plan of the technology



1. Dig 1.70 meter deep
2. Distance of the slope accounting for 1.80 meter
3. Ridge of the pond accounting for 2.50 meters wide
4. Water inlet with a diameter of 8 inches
5. Water outlet with a diameter of 8 inches

Location chosen to build a nursery

1. A place near the shoreline so that a large amount of sea water can be used for cultivation and water drainage

2. A source where sea water has salinity not lower than 25 ppt. throughout the year because sea grapes can grow well in the sea water with salinity between 25-35 parts in 100 (ppt.). The place where the farm is located at should be habitats close to the open sea. It should not be situated at the canal with brackish water carried a long way from the open sea making the water have low salinity in the rainy season. This is due to the fact that expenses are required and it takes time in adjusting salinity. If this is so, costs of cultivation increase.

3. Communication is convenient: There is readiness in terms of public utility systems such as electricity, tap water etc.. This is important for equipment, instruments using electricity in sea grapes cultivation. For the water system, fresh water is used in the farm to wash equipment or to reduce the salinity level of the sea water.

4. The place should be far away from industrial factories or sources of agricultural farming using chemicals or being pollution sources. In fact, sea grapes can tolerate chemicals or pollution only very little. Sea grapes can be accumulated with some chemicals. This can affect consumers. Therefore, the farm location should be far away from the mentioned place.

5. The place should be the source where good sea grape species can be found easily.

6. The size of the pond should not exceed 2 rai whereby the dimension is as follows: dig 1.70 meter deep; distance of slope is 1.80 meters; Ridge of the pond accounting for 2.50 meters wide

7. Dry the pone in the sun for at least 15 days. Spread lime for adjusting the pond bottom with the rate of 15 kg./rai.

8. Pump sea water to flood the soil surface at the pond bottom for the height of 50 centimeters in order to coat it with concrete for 2 days. Then, discard the water.

9. Pump sea water into the pond for about a half of the pond, making it convenient for transplanting sea grapes on the soil surface at the pond bottom for the spacing of 50x50 centimeters. When transplantation is finished, fill up the pond with water.

Note If the pond is old, it should be dried, spread with lime for adjusting the pond bottom. Drying the pond so that the pond bottom is exposed to sunlight and oxygen helps organic matters piling up in the pond decompose better. This helps improve the growth rate of sea grapes.

3. Financing and external material support

Revenues and expenses in using the technology

1. Initial costs and expenses in using the technology

Inputs	Unit	Quantity	Expenses per unit (Baht)	All expenses per inputs (Baht)	% of expenses incurred by land users
Labor					
Labor for planting in the area	Labor	1	300	300	100
Equipment					
Water pump of 0.5 horse power	Pump	1	2,500	2,500	100
Wheelbarrow	Item	1	6,000	6,000	100
Oxygen concentrator	Machine	1	5,000	5,000	100
Super Charge air compressor	Machine	1	4,000	4,000	100
Skimmer	Machine	5	500	2,500	100
500 liter plastic bucket	Bucket	5	2,000	10,000	100
Second-hand 120 hp. diesel sea water pump	Machine	1	15,000	15,000	100
8 inch water sucker	Machine	1	10,000	10,000	100
Water salinity meter	Machine	1	300	300	100
8 inch PVC tube with the length of 3 meters	Piece	3	1,000	3,000	100
Spin and dry machine	Machine	1	1,000	1,000	100
Yield storage basket	Item	5	400	2,000	100
Plant materials					
The variety used in the area of 2 rai	Kilogram	1,000	50	50,000	100
Service wage in building the nursery					
Materials and equipment in building the nursery including labor costs	Square meters	30	5,000	150,000	100
Digging the culture pond	Rai	2	20,000	40,000	100

Total expenses of establishing the technology				301,300	
Total expenses of establishing the technology (US dollars)				9,130	

Calculation of costs and expenses

Expenses are calculated to technology-based areas (Unit of size and area: 2 rai)

The currency used to calculate expenses with the unit as Baht

Exchange rate (to US. dollars) 1 US. dollars = 33.0 Baht

Average wage in hiring labor per day is 300 Baht

Most important factors having effects on expenses

1. Labor cost
2. Electricity cost
3. Fuel cost

2. Maintenance costs

Inputs	Unit	Quantity	Expenses per unit (Baht)	All expenses per inputs (Baht)	% of expenses incurred by land users
Labor					
Management during culture	Force	1	1,000 Baht/month	12,000	100
Yield management and management after harvesting	Force	1	1,000Baht/month	12,000	100
Others					
Electricity cost	Baht	12	1,600	19,200	100
Diesel costs	Baht	12	1,000	12,000	100
All expenses of technological maintenance				55,200	
All expenses of technological maintenance (US dollars)				1,672	

3. Incomes from selling products and net income

- In an area of 1 rai, yields can be harvested for 1,200 kilograms (already selected to remain 600 kilograms) and in 1 year, harvesting can be conducted for 10 times. Therefore, all yields will be obtained accounting for $600 \times 10 = 6,000$ kgs./rai/year

- The wholesale price in front of the farm is 120 Baht per kilo. The total income accounts for $6,000 \times 120 = 720,000$ Baht.

- The sorting out cost is 20 Baht per kilo. Therefore, the selection cost accounts for $1,200 \times 10 \times 20 = 240,000$ Baht.

- The net income/rai/year accounts for $720,000 - 240,000 = 480,000$.

4. Environment

The mentioned area has the average amount of rainwater accounting for 987.40 milliliters, which is at the semi-dry level. The area is flat and 1 meter from the mean seal level. The soil depth is more than 120 centimeters. The soil texture on the top is fine clay. The soil texture at the bottom is clay. The level of organic matters is high (>3%). The ground water cannot be used. The water at the soil surface is at the level which is more than enough. Regarding the water quality (not treated yet), the water can be used for agriculture only. The soil is coastal saline soil.

Impact in the on-site from using the technology

Economic and social impact

Aspect	Impact	Before	After
1. Variety of products	Very positive	The area was used for salt farming and raising Brine shrimps. Small quantities of yields were obtained, which did not cover the expense.	Sea grapes culture and introducing shrimps and crabs in the culture system have brought about diversities.
2. Area for production	Positive	A little	When farmers receive knowledge transfer, the area of production has been expanded more.
3. Expenses of agricultural factors of production	The impact can be ignored.		
4. Farm incomes	Most increase	Loss from raising Brine shrimps	Receive average profit of 480,000 per rai
5. Variety of income-producing sources	Positive a little	One-way income of raising Brine shrimps	Incomes obtained from sea grapes, shrimps and horse crabs

Social and cultural impact

Aspect	Impact	Before	After
1. Food security and self-reliance	Positive	One-way income of raising Brine shrimps	One-way income of raising Brine shrimps
2. Institute of the community	Positive	-	Unity of people in the community has been brought about more whereby

			people mutually exchange knowledge and experiences.
3. SLM or knowledge of land degradation management	Positive	The knowledge has not been propagated yet.	The technology has been accepted and the knowledge starts to be propagated more widely.

Ecological impact

Aspect	Impact	Before	After
1. Water quality	Very positive	Having problems of waste water	The problem of waste water has been reduced greatly.
2. Soil salinity	Very positive	Salinity level more than 700 ppt	The salinity level of 28-32 ppt is suitable for sea grape culture.
3. Variety of animals	Positive	None	Introducing aquatic animals into the culture, namely Lutjanus, shrimps and horse crabs

Off-site impact from using the technology

Aspect	Impact	Before	After
1. Ability of Changes tolerance / ability of filtration (by soil, plants, wetlands)	Positive	Due to being the area of salt farming, the soil is very saline. There are no plants growing at all.	The area of mangrove forests has been adjusted better. Swamp forests appear more. A variety of plants starts to appear.
2. Pollution occurs at the seaside.	Positive	Waste is released from the system.	Seaweed culture helps get rid of waste, making sea water become cleaner.

5. Acceptance of the technology and application

There is acceptance among farmers. They implement the technology through sea grapes culture. This is done by circulating water and treating natural water to keep balance of the ecosystem to be suitable for living of aquatic animals. This condition lasts throughout sea grapes cultivation without draining the water going through cultivation and organic matters into the environment or this culture is so-called Zero Waste Farm. Apart from obtaining

products which are sea grapes, by-products resulting from releasing shrimps and horse crabs can be utilized and increase values.

Activities Pictures



Left picture The area was previously used for salt farming, Farmers faced problems of falling prices of salt.

Right picture The size of the pond should not exceed 2 rai by digging 1.50 meter deep, making the slope distance of 1.80 meters and the pond ridge of 2.50 meters wide.



Left picture Pump sea water into the pond for the water amount of 1.5 meters high.

Right picture Transplant sea grapes on the soil surface at the pond bottom with plant spacing of 50 x 50



Left picture Cleaning by using skimmer to circulate air in the water and produce very fine air bubbles to remove dirt contaminating the sea grapes



Right picture Sorting out sea grapes for distribution (Photographer : Kulvadee Sutthawat)

VDO LINK : <https://www.youtube.com/watch?v=11G9d2Zcej0>